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(54) METHODE DE PRODUCTION D'ALIMENTS AGGLOMERES POUR LES ANIMAUX
(54) METHOD FOR PRODUCING PELLETIZABLE FEED

(57)

There is provided a process for producing pelletizable animal feeds having high nutrient value, comprising initially preparing a high-fat meal of oleaginous seed material and oil therefrom, e.g. canola, and legume material such a peas, by extrusion thereof, and adding to the high-fat material alfalfa. There are also provided a pelletized animal feed comprising a legume material, an oleaginous seed material residue, oil/fat from oleaginous seeds and alfalfa, said feed material having a protein content (basis) of from 15 - 25% by weight; a crude fibre content of from 15 - 25% by weight; an oil/fat content of from 6.5 - 10.5% by weight; bypass (UIP) protein content of from 40 -60% by weight of total protein; and total digestible nutrients (TDN) of from 65 - 80% of the total weight.

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(54) Titre : METHODE DE PRODUCTION D'ALIMENTS AGGLOMERES POUR LES ANIMAUX
(54) Title: METHOD FOR PRODUCING PELLETIZABLE FEED

(57) Abrégé/Abstract:
There is provided a process for producing pelletizable animal feeds having high nutrient value, comprising initially preparing a high-fat meal of oleaginous seed material and oil therefrom, e.g. canola, and legume material such a peas, by extrusion thereof, and adding to the high-fat material alfalfa. There are also provided a pelletized animal feed comprising a legume material, an oleaginous seed material residue, oil/fat from oleaginous seeds and alfalfa, said feed material having a protein content (basis) of from 15 - 25% by weight; a crude fibre content of from 15 - 25% by weight; an oil/fat content of from 6.5 - 10.5% by weight; bypass (UIP) protein content of from 40 -60% by weight of total protein; and total digestible nutrients (TDN) of from 65 - 80% of the total weight.

ABSTRACT OF THE DISCLOSURE

There is provided a process for producing pelletizable animal feeds having high nutrient value, comprising initially preparing a high-fat meal of oleaginous seed material and oil therefrom, e.g. canola, and legume material such a peas, by extrusion thereof, and adding to the high-fat material alfalfa. There are also provided a pelletized animal feed comprising a legume material, an oleaginous seed material residue, oil/fat from oleaginous seeds and alfalfa, said feed material having a protein content (basis) of from 15 - 25% by weight; a crude fibre content of from 15 - 25% by weight; an oil/fat content of from 6.5 - 10.5% by weight; bypass (UIP) protein content of from 40 -60% by weight of total protein; and total digestible nutrients (TDN) of from 65 - 80% of the total weight.

TITLE OF THE INVENTION

METHOD FOR PRODUCING PELLETIZABLE FEED

FIELD OF THE INVENTION

This invention relates to a method for producing pelletizable animal feeds, and the feeds produced by this method.

BACKGROUND OF THE INVENTION

Animals generally require vitamins, minerals, protein, carbohydrate, oil (fat) and fibre in their diet in order to thrive. However, the necessary quantity and variety of each of these components varies depending on the type of animal, its condition, use and age. Moreover, where a conventional feed diet is supplemented with other food sources, such as soy products or grazing, the nutritional components necessary in the conventional feed will vary.

Ruminant animals such as cows present a challenge to the production and design of suitable feeds, as it is frequently desirable to ensure that nutrients are available for absorption at the appropriate stage of digestion and are not destroyed or metabolized by bacteria in the rumen. Moreover, cows producing milk require higher levels of by-pass protein (UIP) than are required by non-milk producing cows. The nutrient profile of feeds may be adjusted to provide for efficient nutrient utilization. For example, feeds for ruminant animals should reflect the impact of rumen digestion on nutrient availability to the animal.

The rumen is the first stomach of a ruminant animal. Feed entering the rumen is fermented by microorganisms, and the fermented feed and bacterially produced products are passed on to subsequent digestion in the animal's other stomachs. It is undesirable to feed ruminant animals high levels of starch, as the starch will ferment rapidly and may create acidic conditions in the rumen, leading to acidosis, inefficient feed utilization and excessive heat generation. Thus, where a high-energy feed for ruminant animals is required, it is preferable to use non-starch energy sources such as fats to provide the additional energy.

Rumen bacteria typically degrade soluble proteins in ruminant animal feeds. The rumen bacteria then produce proteins which are passed on to digestion by the animal. However, where high levels of protein or high levels of one or more particular amino acids are required by the animal, it is frequently desirable to modify proteins in ruminant animal feeds to reduce digestion by rumen bacteria, allowing the modified proteins to bypass ruminal degradation and proceed to subsequent conventional digestion.

The total protein content of a feed reflects the various protein components in that feed. Different components provide different amino acids. The requirements of different animals for particular amino acids typically varies with several factors including the type of animal and the demands placed upon it. Thus, not only is it important that a feed have an adequate level of available protein, but the available protein must contain appropriate levels of the necessary amino acids. As different grains and legumes typically contain different levels and types of amino acids, it is frequently beneficial to use more than one type of grain or legume in the production of a feed. For example, peas supply a high level of digestible amino acids, particularly lysine.

Oleaginous seeds such as canola seeds, soybeans, cottonseeds and sunflower seeds are useful components of animal feeds because they contribute oils as well as protein to the final feed. However, such seeds frequently contain anti-nutritional factors which limit their value as feed components in the absence of heat processing. For example, the heat and pressure of extrusion reduce the levels of glucosinates and myrosinase found in canola, thereby reducing the potential formation of toxic metabolites of these compounds. The process of extrusion also ruptures the cells of the canola, allowing the canola oil to become exposed to lipolytic enzymes which partially breakdown these oils thereby improving overall digestibility of the feed product.

Similarly, legumes such as peas may be a valuable source of protein and carbohydrate in a feed. However, some legumes contain anti-nutritional factors which significantly limit the nutritional value of these unprocessed legumes. For example, peas contain trypsin inhibitors, saponins and tannins which may be substantially inactivated by extrusion or expansion processing.

It is desirable to have a means to produce animal feeds containing all the factors necessary for the growth and production requirements of a particular type of animal. Factors of particular interest include vitamins and minerals, oils (or fats), protein, carbohydrates, and fibre. Moreover, depending on the species and class of animal and the other components of its diet (if any), the desirable quantity and type of each factor may vary. It is also desirable to be able to produce animals feed which are pelletizable, for ease of handling and improved utilization.

Current methods for the production of animal feeds limit the nutrient ranges and feed varieties which may be produced. In particular, current methods typically rely on a

single-stage extrusion or expansion process wherein all the desired feed components are combined prior to processing. Extrusion or expansion is typically employed in order to enhance oil retention and to reduce the presence of anti-nutritional factors such as glucosinolates (which may be hydrolyzed to form toxic factors), and protease inhibitors and bacteria. However, the high heat involved in extrusion and expansion processes frequently reduces the available nutrients to the animal from the final feed. Nutrient availability may be compromised due to the degradation of nutrients upon heat and/or pressure treatment. Alternatively, nutrient availability may be altered by changes in nutrients induced by heat and/or pressure treatment. For example, heat processing tends to denature proteins, causing them to become insoluble and less subject to digestive enzymes. At times this may be desirable, such as where partial protein denaturation is desired to increase bypass (UIP) protein content.

It is desirable to have a method for the production of pelletizable animal feeds containing the nutritional components necessary for animal growth and production in a form suitable for digestion and absorption by the animal. The quality, as well as the quantity, of each nutritional component is important. It is desirable to provide high quality oil, protein and fibre in an animal feed. For example, feed containing high quality protein would contain high levels of key amino acids in a form suitable for digestion by the animal. Oil quality is largely determined by its degree of saturation and fatty acid content, as well as the level of anti-nutritional agents such as lipases. Fibre quality is largely determined with reference to the levels of lignin, cellulose, and hemicelluloses in relation to total fibre. However, limitations on current methods for the production of pelletizable feeds prevent the development of complete feed programs for many animals.

The capacity of a feed to form a stable pellet depends on several factors, including the moisture and oil or fat content of the feed. It is not generally possible to pelletize feeds having an oil or fat content in excess of 10 % using conventional methods.

Brief Reference to the Prior Art

PCT Patent Application PCT/US95/11735 of Rokey discloses a process for the production of animal feeds having high soluble protein wherein starch and protein fractions are processed differently from one another, thereby reducing heat-induced protein insolubility. However, the method of Rokey is unsuitable for use with feed components which, while susceptible to heat, require some heat treatment in order to reduce anti-nutritional factors.

Canadian Patent 1,053,498 of Steinke discloses a two-stage process for manufacturing hard, dry high fat animal feed pellets involving the mixture of divided oleaginous seeds with an oil-protein blend, followed by steam heating and pelletization. This method allows the production of high-fat feed pellets. However, the method does not allow the production of a feed having levels of other nutrients suitable for many animals.

PCT Patent Application PCT/NL92/00167 of Van Bruggen discloses a single stage method for reducing the amount of anti-nutritional factors in a raw material mixture containing raw rape seed (canola) for producing an ingredient for an animal feed, comprising subjecting the raw material mixture to stream treatment. While this patent application discloses a means for reducing the anti-nutritional factors found in raw canola in the absence of extrusion or expansion, it fails to provide a means for the treatment of feeds containing a range of feed components while preserving and/or improving broad nutrient availability.

SUMMARY OF THE INVENTION

It is an object of the invention to provide a novel method for the production of a pelletizable animal feed.

It is a further object of the invention to provide a high fat content, pelletized animal feed.

The present invention provides, from one aspect, a multi-stage process whereby a legume material and an oleaginous seed material are mixed, in a first step, and this "first mixture" is processed, e.g. by extrusion so that the structure of the oleaginous seed material is disrupted to expel the oil/fat therefrom, into the mixture, thereby producing a high-fat meal. This high-fat meal is then combined with fibre meal comprising alfalfa, to produce an intermediate meal, can then be conditioned and pelletized, to produce the final animal feed. The result is an animal feed containing high contents of oil or fat, e.g.10% or more by weight, which can nevertheless be pelletized despite its high oil content, and one which is high in bypass protein (UIP) content and in total digestible nutrients (TDN).

Thus according to the invention, in one aspect, there is provided a process for preparing a pelletized animal feed of a legume material, an oleaginous seed material and alfalfa, which comprises:

- mixing the legume material and the oleaginous seed material in appropriate proportions, to form a first mixture;

- subjecting the first mixture to oleaginous seed structure disrupting conditions so as to free the oil therefrom and form a high-fat meal of legume material, oleaginous seed residue and oil;

- mixing alfalfa into said high-fat meal, in appropriate quantities, to produce an intermediate meal;

- and conditioning and pelletizing said intermediate meal to form high oil/fat content, pelletized animal feed.

Another aspect of the present invention provides a pelletized animal feed comprising a legume material in an amount of from 10% -25% by weight, alfalfa in an amount of from 50% - 85% by weight, and an oleaginous seed material residue and oil/fat from the oleaginous seeds, the oil/fat and seed material residue constituting 10% - 25% of the feed, said feed having a protein content (basis) of from 15 - 25% by weight; a crude fibre content of from 15 - 25% by weight; an oil/fat content of from 6.5 - 10.5% by weight; bypass (UIP) protein content of from 40 -60% by weight of total protein; and total digestible nutrients (TDN) of from 65 - 80% of the total weight.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURES 1 A and B are graphical representations of the time course of nutrient availability from various animal feeds.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention overcomes the problem of excessive rumen digestion of proteins by providing a high level of bypass protein which has been processed to reduce its solubility, making it less susceptible to use and alteration by rumen microorganisms, and

allowing a significant quantity of feed protein to pass through the rumen and into subsequent stomachs for conventional digestion by the ruminant animal.

The term "legume material" when used herein refers to material containing significant levels of both starch and protein derived from one or more legumes other than alfalfa. The preferred legume material for use in the present invention is peas. Different feed components also contribute other nutritional factors such as carbohydrates, fibre, vitamins and minerals to the feed. Peas largely contribute non-structural carbohydrates which are valuable as nutritional factors in their own right, and are also useful in absorbing oils released from other feed components. It has been discovered that unextruded alfalfa meal contributes high quality fibre and protein as well as various vitamins such as betacarotene.

To support optimal animal growth and production, a system of animal feeds should not only provide necessary nutrients, but should provide nutrients in a steady supply to avoid "lag" periods where energy levels are low. Existing systems of animal feeds are limited in their ability to provide such a steady energy supply, and "lag"periods are frequently observed. Surprisingly, the pelletizable feeds of the present invention are useful in the provision of a steady supply of energy to animals. Pelletizable feeds of the present invention may be used to provide energy during the "lag" period observed with conventional feeds. Figure 1 A depicts the time course of energy availability from conventional feeds, and the "lag" period typically observed in such feed systems. Figure 1 B shows how one of the pelletizable feeds of the present invention, designated SUPER GREEN™, overcomes the limitations of conventional feed systems by providing energy during what would otherwise be a "lag" period.

In order to produce a pelletizable feed offering a desirable nutrient balance and free from undesirable levels of anti-nutritional factors, the nutrient content and anti-nutritional factor levels of alfalfa were examined. Surprisingly, it was found that alfalfa provides high levels of desired nutrients and levels of anti-nutritional factors which are sufficiently low to allow use in feeds without extrusion or expansion. It was further found that the nutrient potential of alfalfa was most effectively utilized when it was not processed by extrusion or extraction. It was found that high bypass protein levels could be obtained from alfalfa by dehydration, without extrusion or extraction. Accordingly, the process of the invention conducts extrusion on the mixture of oleaginous seed and legume material, and the alfalfa is added subsequently.

The method for producing the pelletizable feeds of the present invention thus comprises a novel multi-step process whereby, in a first step, a first mixture comprising legume material and oleaginous seed material is heat and pressure processed to produce a high-fat meal, and, in a second step, the high-fat meal of the first step is combined with a fibre meal comprising reduced-water alfalfa to produce an intermediate meal. In a third step, the intermediate meal is conditioned to form a pelletizable feed.

The nutrient profiles of various feed components were examined for suitability for use with alfalfa to form pelletizable feeds. As alfalfa is relatively low in fat, it is desirable to use oil sources such as unrefined oleaginous seed material in the production of feeds having a significant oil content. The term "oleaginous seed material" when used herein refers to oleaginous seeds such as canola, sunflower or soyabean and includes a combination of oil/fat released from oleaginous seeds and oleaginous seed material residue. The preferred oleaginous seed material is unrefined canola seed material. The term "unrefined oleaginous

seed material" when used herein refers to material containing all the components of oleaginous seeds substantially in their usual proportions. A significant feature of the preferred embodiments of this invention is that the whole canola seed is used.

Due to the high levels of anti-nutritional factors in many oleaginous seed materials, and particularly in canola, it is preferred that the oleaginous seed material be treated using heat and pressure processing to reduce such factors and enhance bypass protein levels, prior to combination with alfalfa. Heat and pressure processing of oleaginous seed material causes oleaginous seeds within the oleaginous seed material to rupture, permitting release of oil/fat from the oleaginous seeds. The husk and other components of the oleaginous seed are called oleaginous seed material residue. Means of heat and pressure processing, including without limitation, extrusion and expansion, are known in the art. The optimum extrusion or expansion temperature will vary, depending on the moisture content of the material to be extruded or expanded and the residence time of this material in the extruder or expander. A typical extruding temperature for the high-fat meal made in the process of the present invention is from 265 - 268 °F. Appropriate such conditions for extrusion or extraction can be routinely determined.

The preferred legume material, peas, has also been found to have a nutrient profile making them eminently suitable for use in feeds in combination with alfalfa. As with oleaginous seeds, it may be desirable to treat the peas to reduce the presence of active anti-nutritional factors and to increase bypass protein, prior to combination with alfalfa. Preferably, the peas are heat and pressure processed (for example by extrusion or expansion) to reduce anti-nutritional factors prior to combination with alfalfa. The term "unrefined pea

material" where used herein refers to material containing all the components of pea seeds substantially in their usual proportions.

Peas contain high levels of starch and it has been noted that when peas and oleaginous seeds such as canola are extruded or expanded together, the starch from the peas absorbs the oil released from the oleaginous seeds, allowing the production of a meal with good flow characteristics and a high oil content. Thus, in a preferred embodiment of a first step of the invention, oleaginous seeds (preferably canola) and legume material (preferably peas) are combined to form a first mixture and this first mixture is subjected to heat and pressure processing by extrusion or expansion to form a high-fat meal. Preferably also, the first mixture is preconditioned prior to heat and pressure processing. Methods of preconditioning are known in the art and include, without limitation, steam conditioning.

This first mixture preferably comprises substantially equal proportions of oleaginous seed material and legume material. In one embodiment of the invention, the first mixture further includes minor proportions of other suitable materials such as legume meal. The term "legume meal" when used herein refers to material derived from one or more legumes which is processed to be suitable for use as a feed component. In some instances it will be desirable to use reduced water legume meal. One example of a legume meal is reduced water alfalfa meal. Such materials may be added to enhance certain characteristics of the high-fat meal, such as nutrient content or flowability.

The high-fat meal from the first step of the method of the invention is combined with a fibre meal, namely alfalfa meal, having a nutrient profile complementary to the high-fat meal. This alfalfa may be treated prior to incorporation into the feed, for example by water reduction. A reduced water alfalfa meal may be produced by a variety of

methods known in the art, including conventional dehydration and sun-curing. Where desired, the alfalfa may be treated to reduce the presence of anti-nutritional factors prior to combination with the other feed components. Alternatively, and preferably, the reduced water alfalfa meal is combined with the high fat meal from the first step of the process to form an intermediate meal, and the intermediate meal is steam conditioned using standard means prior to pelletization. Steam conditioning enhances nutritional characteristics of the feed by facilitating hydrolysis of starch and pectin.

Since exposure to heat may reduce the available nutrients in the feed, it is desirable to optimize the duration and temperature of steam conditioning. The precise characteristics of the intermediate meal will vary with the raw ingredients used, so that it is preferable to refine the precise process conditions for each batch of feed. Methods of monitoring relevant factors such as nutritional characteristics and starch and pectin hydrolysis are known in the art. The level of available nutrients in the feed may be assayed using standard means. Moreover, the effect of steam conditioning on the pelletizability of the feed may be determined by examining the ability of feed to form a stable pellet following steam treatment for various time periods. Thus, the preferable duration and temperature of conditioning is the duration and temperature combination which provides adequate starch and pectin hydrolysis, adequate reduction of anti-nutritional factors and allows the feed to be pelletized, without substantially reducing the level of desired nutrients in the feed. Such adjustments are within the skill of the art.

In some instances it will be desirable to include additional amounts of legume materials such as pea materials in the fibre meal to provide a desired nutrient mix in the pelletizable feed. It may also be desirable to add preservatives to enhance the storage life of

the pelletizable feed. Suitable such preservatives are known in the industry. One specific example is an anti-oxidant such as ethoxoquin, which may be added prior to steam conditioning.

The proportions and type of legume material and oleaginous seed material employed in the production of the high-fat meal are preferably selected to produce a high-fat meal having preferably between 15 % and 25 % oil (fat), more preferably between 20 and 22 % oil (fat).

The components selected for use in the method of the invention to form pelletizable feeds are preferably selected to produce pelletizable feeds comprising high quality protein, oil, and fibre and having: a protein content (basis) preferably between 18 and 22 %, more preferably between 18 and 20 %; a crude fibre content preferably between 15 % and 25 %, more preferably between 17 % and 22 %; an oil (fat) content preferably between 6.5 - 10.5 %, more preferably between 8-10 %; bypass (UIP) protein preferably between 40 and 60 % of total (basis) protein, more preferably between 45 and 55 % of total protein; and, total digestible nutrients ("TDN") preferably between 65 and 80 %, more preferably between 70 and 75 %, even more preferably 72 %. The exact nutrient profile of feeds produced by the method of the invention will vary depending on the quality and quantity of raw ingredients used. It is within the capacity of a competent technician, in light of the information disclosed herein, to select the quantity and quality of raw ingredients suitable to produce a pelletizable feed of the present invention having the desired nutrient profile.

In a preferred embodiment, the pelletizable feed of the invention is formed into pellets or cubes of an appropriate size following conditioning. The appropriate size for pellets or cubes will vary with the animal for which the feed is intended. However, it is

within the capacity of a competent technician to determine the appropriate size for pellets or cubes in light of the animal of interest.

Preferred embodiments of the method and products of the invention are further described in the following non-limiting examples:

Example 1 Application of Method to Production of "Super Green" Feed

A first mixture was produced by combining 47.5 % (w/w) whole canola seed, 47.5 % (w/w) whole pea seed meal, and 5 % (w/w) dehydrated alfalfa meal. The first mixture was processed by standard extrusion methods to form a high-fat meal. The high-fat meal was analyzed by standard means and found to contain approximately 21 % (w/w) oil.

A reduced water alfalfa meal was produced by dehydrating alfalfa and crushing by standard means. The resultant reduced water alfalfa meal was used to form the fibre meal without the addition of other materials.

An intermediate meal was formed by mixing approximately 35 % high-fat meal, 65 % fibre meal, and 0.025 % ethoxoquin. The intermediate meal was steam conditioned by standard means to form a pelletizable feed. The pelletizable feed was formed into pellets using standard techniques.

The pelletizable feed formed was analyzed by standard means and found to contain approximately 72 % TDN, 18.5 % total protein (50 % of which was bypass protein), 8.8 % oil (fat) and 18 % crude fibre. Table 1 A depicts a typical nutrient profile for SUPERGREEN feed. Actual nutrient levels will vary depending on the quality of raw materials used. Based on the information disclosed herein, a competent technician can select raw materials appropriate to provide nutrient values within 10 % of those depicted in Table 1

A. The pelletizable feed was found to be suitable for use as a complete feed for milk-producing cows.

Example 2 Application of Method to Production of Sun Gold™ Feed

A first mixture was produced by combining 47.5 % (w/w) whole canola seed, 47.5 % (w/w) whole pea seed meal, and 5 % (w/w) dehydrated alfalfa meal. The first mixture was processed by standard extrusion methods to form a high-fat meal. The high-fat meal was analyzed by standard means and found to contain approximately 21 % oil.

A reduced water alfalfa meal was produced by sun-curing alfalfa by standard means and crushing by standard means. The resultant reduced water alfalfa meal was used to form the fibre meal without the addition of other materials.

An intermediate meal was formed by mixing approximately 25 % (w/w) high-fat meal, 75 % (w/w) fibre meal, and 0.025 % ethoxoquin. The intermediate meal was steam conditioned by standard means to form a pelletizable feed. The pelletizable feed was formed into pellets using standard techniques.

The resultant feed was found to have a higher fibre content than the Supergreen feed described in Example 1, while being less expensive to produce. This feed was found to be suitable for use as a complete feed for lower producing milk cows. Table 1 B depicts a typical nutrient profile for SUN GOLD feed. Actual nutrient levels will vary depending on the quality of raw materials used. Based on the information disclosed herein, a competent technician can select raw materials sufficient to provide nutrient values within 10 % of those depicted in Table 1 B.

Table 1A - A-Plus Super Green - Typical Nutrient Profile (90% dry matter basis)

Ingredient	Amount
Crude Protein	18.50%
Crude Fat (EE)	8.80%
Crude Fibre	18.10%
Acid Detergent Fibre	22.10%
Neutral Detergent Fibre	31.00%
Total Ash	7.90%
Moisture	9.50%
TDN (Ruminants)	72.00%
NEl	1.64 MCal/kg
ME (Ruminants)	2.60 MCal/kg
DE (Swine)	2845.00 KCal/kg
Calcium	1.00%
Total Phosphorus	0.31%
Lysine	0.98%
Methionine + Cystine	0.56%
Methionine	0.31%
Threonine	0.78%
Est UIP (% of CP)	50.00%
Magnesium	0.26%
Potassium	1.90%
Sodium	0.08%
Sulphur	0.33%
Copper	9.20 mg/kg
Iron	290.00 mg/kg
Manganese	33.50 mg/kg
Zinc	26.00 mg/kg
Selenium	0.34 mg/kg

Table 1B - Typical Nutrient Composition of A P Sungold (90% Dry Matter Basis)

Crude Protein	16.5%
Crude Fat	6.5%
Crude Fibre	22.5%
Acid Detergent Fibre (ADF)	26.0%
Neutral Detergent Fibre (NDF)	35.5%
Total Ash	8.25%
Moisture	9.5%
TDN Ruminants	65.0%
NEI	1.48 MCal/kg
ME Ruminants	2.52 MCal/kg
DE Swine	2560 KCal/kg
Calcium	1.10%
Total Phosphorus	0.28%
Lysine	0.84%
Methionine & Cysteine	0.47%
Methionine	0.27%
Threonine	0.72%
Est. UIP (% of CP)	35.5%

WHAT I/WE CLAIM AS MY/OUR INVENTION:-

1. A process for preparing a pelletized animal feed of a legume material, an oleaginous seed material and alfalfa, which comprises:

- mixing the legume material and the oleaginous seed material in appropriate proportions, to form a first mixture;

- subjecting the first mixture to oleaginous seed structure disrupting conditions so as to free the oil therefrom and form a high-fat meal of legume material, oleaginous seed residue and oil;

- mixing alfalfa into said high-fat meal, in appropriate quantities, to produce an intermediate meal;

- and conditioning and pelletizing said intermediate meal to form high oil/fat content, pelletized animal feed.

2. The process of claim 1 wherein the legume material comprises unrefined pea seed material.

3. The process of claim 2 wherein the oleaginous seed material comprises unrefined canola seed material.

4. The process of claim 2 wherein the alfalfa component is reduced-water alfalfa meal.

5. The process of claim 4 wherein the alfalfa material comprises dehydrated alfalfa meal.

6. The process of claim 4 wherein the reduced-water alfalfa meal comprises suncured alfalfa meal.

7. The process of claim 1 wherein the first mixture comprises substantially equal weights of legume material and oleaginous seed material.

8. The process of claim 1 wherein the first mixture further includes legume meal.

9. The process of claim 8 wherein the legume meal is reduced water legume meal.

10. The process of claim 1 wherein the first mixture is subjected to seed disrupting conditions by extrusion.

11. The process of claim 1 wherein the intermediate meal is steam conditioned.

12. The process of claim 1 wherein the intermediate meal further includes a preservative.

13. The process of claim 1 wherein the high-fat meal has an oil content of between 15 % and 21 %.

14. The process of claim 10 wherein the first mixture is preconditioned prior to extrusion.

15. A pelletized animal feed comprising a legume material in an amount of from 10% -25% by weight, alfalfa in an amount of from 50% - 85% by weight, and an oleaginous seed material residue and oil/fat from the oleaginous seeds, the oil/fat and seed material residue constituting 10% - 25% of the feed by weight, said feed having a protein content (basis) of from 15 - 25% by weight; a crude fibre content of from 15 - 25% by weight; an oil/fat content of from 6.5 - 10.5% by weight; bypass (UIP) protein content of from 40 -60% by weight of total protein; and total digestible nutrients (TDN) of from 65 - 80% of the total weight.

16. The pelletized feed of claim 15 wherein the legume material is peas and the oleaginous seeds are canola.

17. The pelletized feed of claim 16 having an oil content from 8 - 10.5 %.

18. The pelletized feed of claim 17 having an oil content from 8 - 10 %.

19. The pelletized feed of claim 18 having a protein content from 18 - 22 %.

20. The pelletized feed of claim 19 having a protein content from 18 - 20 %.

21. The pelletized feed of claim 20 having a crude fibre content from 15 - 25 %.

22. The pelletized feed of claim 21 having a crude fibre content from 17 - 22 %.

23. The pelletized feed of claim 22 having a by-pass protein content from 40 - 60%.

24. The pelletized feed of claim 23 having a by-pass protein content from 45 - 55%.

25. The pelletized feed of claim 24 having a TDN of from 65 - 80 %.

26. The pelletized feed of claim 25 having a TDN of from 70 - 75 %.

27. A process for preparing a pelletizable intermediate meal suitable for conditioning and pelletizing to form the pelletized animal feed of claim 15, said process comprising:

mixing a legume material and an oleaginous seed material in appropriate proportions, to form a first mixture;

subjecting the first mixture to oleaginous seed structure disrupting conditions so as to free oil therefrom and form a high-fat meal of legume material, oleaginous seed residue and oil; and

mixing alfalfa into said high-fat meal, in appropriate quantities to produce pelletizable intermediate meal.

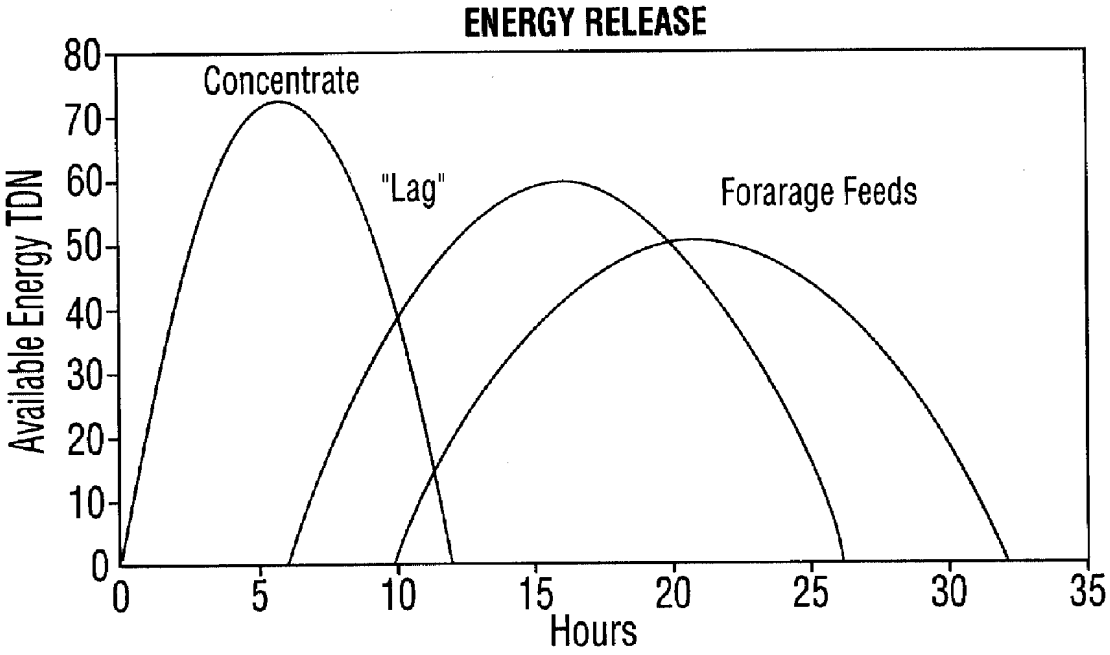
ENERGY RELEASE
Concentrate
"Lag"
Forarage Feeds
Available Energy TDN
80
70
60
50
40
30
20
10
0
0
5
10
15
20
25
30
35
Hours

FIG. 1a

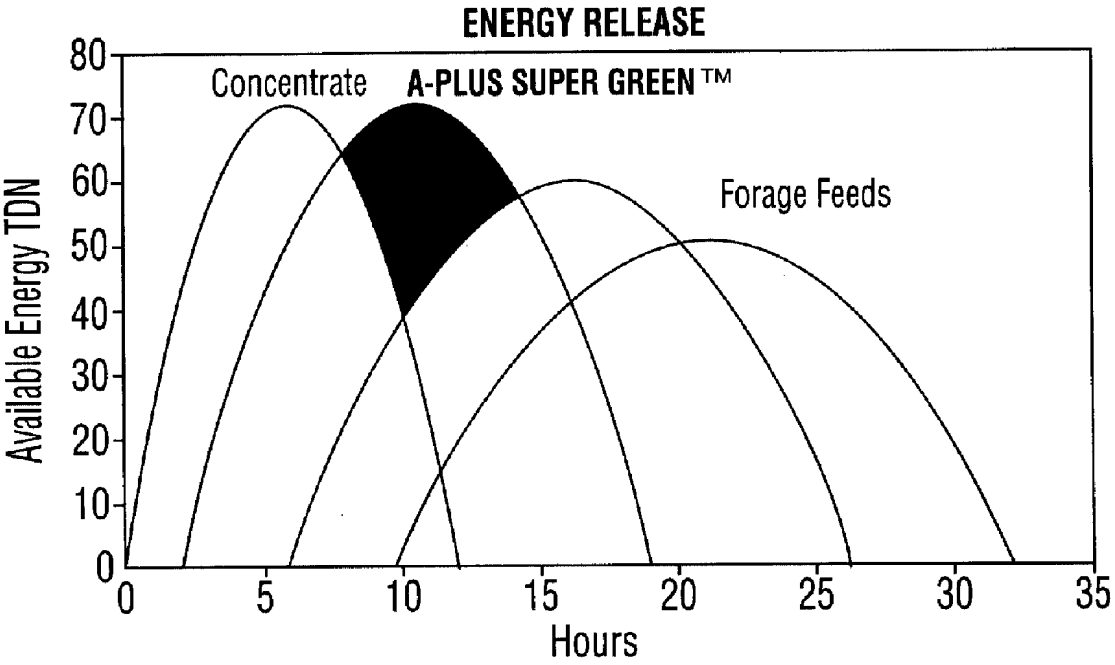
ENERGY RELEASE
Concentrate
A-PLUS SUPER GREEN™
Forage Feeds
Available Energy TDN
80
70
60
50
40
30
20
10
0
0
5
10
15
20
25
30
35
Hours

FIG. 1b